

REMARKS

Reconsideration of the application is requested.

Claims 1-8 remain in the application. Claims 1, 2, and 4-8 have been amended. A marked-up version of the claims is attached hereto.

In item 6 on page 3 of the above-identified Office Action, the Examiner objected to the title as not being indicative of the invention. Accordingly, the title has been amended to add the word "capacitor" to even more clearly describe the invention of the instant application. It is therefore submitted that the title is now properly descriptive of the invention of the instant application.

In item 8 on page 3 of the above-identified Office Action, the Examiner objected to the specification. Specifically, the examiner has stated that the specification does not provide proper antecedent basis for claims 2-6.

Applicants respectfully submit that claims 2-6 are properly supported by the specification. Specifically, the limitations of claim 2 are set forth on page 5, lines 20-25 of the specification; the limitations of claim 3 are set forth on page 6, lines 1-3; the limitations of claim 4 are

set forth on page 6, lines 8-11; the limitations of claim 5 are set forth on page 6, lines 13-16; and the limitations of claim 6 are set forth on page 6, lines 18-20.

It is accordingly believed that the specification and the claims meet the requirements of 35 U.S.C. § 112., 37 C.F.R. 1.75(d)(1), and MPEP § 608.01.

In item 9 on page 3 of the above-identified Office Action, claim 2 has been objected to under 37 C.F.R. 1.75(c). Specifically, the Examiner has stated that claim 2 is in improper dependent form. The Examiner's objection has been noted and claims 1 and 2 have been amended to provide proper antecedent basis for the limitations of claim 2. It is therefore believed that the objection to the claim has been overcome.

In item 11 on page 4 of the above-identified Office Action, claims 1-8 have been rejected as being obvious over Golden et al. (U.S. Patent No. 5,618,751) in view of Tsai (U.S. Patent No. 5,913,132) under 35 U.S.C. § 103(a).

The rejection has been noted and the claims have been amended in an effort to even more clearly define the invention of the instant application. Support for the changes is found on page 12, lines 23-26 of the specification of the instant application.

Before discussing the prior art in detail, it is believed that a brief review of the invention as claimed, would be helpful. Amended claim 1 calls for, *inter alia*:

A method for forming a trench with a buried plate, which comprises:

forming a trench in a substrate, the trench having a sidewall, an upper region, and a lower region;

forming a substantially undoped silicon oxide layer on the trench sidewall in the upper and lower regions of the trench;

forming a doped silicate glass fill in the upper and lower regions of the trench;

removing the doped silicate glass fill and the undoped silicon oxide layer from the upper region of the trench with an etching process, the silicate glass being completely removed through the underlying undoped silicon oxide; and . . .

Claim 1 discloses a homogenous substantially undoped silicon oxide layer formed below the silicate glass fill, which keeps the dopant from the silicate glass fill away from the sidewall of the trench. Thus, the method for producing a trench with a buried plate according to the invention has the

advantage that no dopant residues remain in the upper region of the trench (page 12, lines 23 to 26).

The Golden et al. reference discloses a trench capacitor wherein a drive-in layer of arsenic doped glass is conformally deposited within the trench (column 4, lines 19 to 22). The drive-in layer is directly deposited on the sidewall of the trench and is removed in the upper region of the trench by a subsequent etching step. With respect to Fig. 6, it is shown that an oxide layer is deposited above the drive-in layer. While Golden et al. recognized that doping of the upper regions of the trench is prevented during the drive-in cycle by the oxide layer (column 7, lines 15 to 17), the problem of leaving residue of the dopant in the upper region of the trench is not addressed.

The Tsai reference discloses a method of making a shallow trench isolation region. First, a shallow trench is etched into a silicon substrate and in a subsequent step a sidewall oxide layer is grown on the sulfate of the silicon substrate within the shallow trench (column 1, lines 52 to 58).

Thereafter, one or more layers of doped and undoped oxide material is deposited over the silicon substrate. It is an object of the Tsai document to provide a sealing of the shallow trench by depositing a doped dielectric layer which

requires a lower temperature as compared to a dielectric layer without dopants (column 4, lines 44 to 48). The shallow trench structure according to the Tsai document does not disclose the provision of an upper and a lower region of the trench and the removal of the doped and undoped dielectric layers in the upper region of the trench with an etching step.

If the teachings of Golden et al. and Tsai were combined, a person skilled in the art would be motivated to deposit the undoped oxide layer within the sidewalls of the trench and thereafter deposit the doped silicate glass fill. There is, however, no suggestion or motivation in the Tsai document to remove the undoped silicon oxide layer in a subsequent process step from the upper region of a trench. Furthermore, there is no suggestion or motivation in either document to apply an undoped silicon oxide layer in a trench capacitor arrangement in order to prevent residues of the dopant according to the invention. It is the object of the present invention to provide an oxide layer on the sidewalls of the trench, thereafter to deposit the doped silicate glass layer, and then to completely remove the silicate glass layer through the underlying undoped silicon oxide. Only with the teachings of the invention in mind, would it be possible to combine the Golden et al. and the Tsai references such that

the inventive method results. This is, however, only possible in a view a posteriori. At the time of the invention, a person skilled in the art had neither a motivation to deposit an oxide layer within the trench of a capacitor underneath a doped layer nor to remove the oxide layer in the upper region of the trench thereafter, as the teachings of both references are not linked with each other and do not give a suggestion or motivation to accomplish this.

It is accordingly believed to be clear that none of the references, whether taken alone or in any combination, either show or suggest the features of claim 1. Claim 1 is, therefore, believed to be patentable over the art. The dependent claims are believed to be patentable as well because they all are ultimately dependent on claim 1.

In view of the foregoing, reconsideration and allowance of claims 1-8 is solicited.

In the event the Examiner should still find any of the claims to be unpatentable, counsel would appreciate receiving a telephone call so that, if possible, patentable language can be worked out.

Appl. No. 10/078,997
Amdt. Dated September 22, 2003
Reply to Office Action of May 22, 2003

Petition for extension is herewith made. The extension fee for response within a period of 1 month pursuant to Section 1.136(a) in the amount of \$110.00 in accordance with Section 1.17 is enclosed herewith.

Please charge any other fees that might be due with respect to Sections 1.16 and 1.17 to the Deposit Account of Lerner and Greenberg, P.A., No. 12-1099.

Respectfully submitted,

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For Applicant(s)

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